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War with Iran – Will Brinkmanship Deter Iran From Building the Bomb?

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Abstract

Iran's policy of nuclear armament has generated the potential of war with the international community. We focus on the Iranian leadership – it is unclear whether a hardline position voiced by the current President Ahmadnihad will prevail over less confrontational voices (for example the son of the late Ayatollah Khomeini) or not. We use a standard game theoretic model for brinkmanship where we allow for the possibility that Iran has an irrational government that wishes to pursue nuclear weapons at all costs. This model suggests that the threat of war has limited effectiveness as a deterrent. We suggest very specific conditions under which a credible deterrent is possible. This paper therefore clarifies the muddy waters of real life decision making by providing a set of decision making criteria.

1 Introduction

The international community seems engaged in a perpetual dance with the Iranian government in their effort to dissuade Iran from developing the nuclear bomb. Iran ostensibly wishes to develop a peaceful nuclear capability and is even a signatory to the NPT (Non Proliferation Treaty). However, Iran's refusal to allow inspectors from the IAEA to monitor this program effectively and repeated pronouncements of its sovereign right to nuclear weapons suggest otherwise to observers (Delpec, 2006 p. 7-24). These mixed signals are exacerbated

by periodic willingness by the Iranian government to negotiate on the one hand and incendiary speeches by Iran's President Ahmadnihad favoring Iran's desire to obtain nuclear arms. The question for the international community remains – which Iran is it dealing with, an "irrational" Iran that wishes to pursue nuclear weapons even at the cost of war and possible regime change or a rational regime that will respond to the threat of war by giving up its ambitions to nuclear weapons to avoid the costs of war (Amuzegar, 2003)? The international community for its part blows war hot or sanctions cold – and all the diplomacy in between – to deter Iran from getting the bomb.

In this paper we use a standard game theoretic model (see for example Dixit Skeath and Reiley, 2009 p. 601-603) to model the effectiveness of the threat of war in this endeavour.¹ We provide an analytical narrative that may help untangle some of the issues faced by the world community in its dealings with an Iran that seems hell bent towards becoming a nuclear weapons state. The question we ask is – Can the threat of war deter Iran from building a nuclear weapon?² The answer to this question matters not only as an issue for the general debate on proliferation but also to defense planners.³ Our innovation is two fold. First of all we find that the effectiveness of this threat of war hinges ultimately on two issues – the likelihood that the Iranian government is steadfast in its pursuit of the bomb and how much this steadfastness matters to the international community relative to the actual outbreak of war. Second, we suggest that if used with appropriate caution, brinkmanship could provide a credible deterrence that would actually prevent the Iranian government from obtaining nuclear weapons. However, this approach would fall short of outright war and so would not lead to a formal invasion if the Iranian government were irrationally wedded to nuclear weaponization. Thus, brinkmanship can be used as a tool to elicit information about the type of Iranian government the world community is dealing with. This in itself would be useful to the policy maker. We further show that it is always possible to formulate a credible threat that could deter a rational Iranian government.

We introduce the fundamental model in section 2 below. We discuss model equilibria in section 3. Section 4 concludes.

¹Dixit, Skeath, and Reilly (2009) actually apply this model to the Cuban missile crisis in 1962. We apply the same basic model to understand elements of the current state of crisis between large parts of the world community and the Islamic Republic of Iran. For a more formal exposition of the use of brinkmanship to deter WMD acquisition by rogue powers see Melese (2009).

²Our approach is somewhat different than the typical approach taken in the literature on the issue of brinkmanship and Iran. Most of the literature on brinkmanship seems to concentrate on the brinkmanship of states wishing to be nuclear powers rather than on the use of brinkmanship to deter nuclear weaponization (see for example Chubin, 1995).

³For example, it is possible to imagine a nuclear Iran more able to flex conventional muscles in a volatile region because of its nuclear deterrence capability (see for example Zaborski, 2005).

2 The Model

We model the interaction between Iran and the international community as a sequential game with asymmetric information. We postulate that the Iranian government may be one of two types – steadfast in its desire to nuclearize or potentially willing to pursue its obligations under the NPT. Nature is the first mover and chooses the type of the Iranian government. There is a $p \in [0, 1]$ chance that a hard-line (R_H) Iranian government will steadfastly pursue nuclear weapons and a $1-p$ chance that a softer (R_S) is willing to negotiate. The Iranian government of course knows its type. The international community (I) knows p . The international community's options are to threaten war or do nothing. Note here that this threat of war can be calibrated with probability $q \in (0, 1]$. Thus, the international community could threaten war by moving naval vessels into the Persian Gulf – slowly upping the ante to creating no fly zones over Iran to targetted strikes within Iran and so on as long as the Iranian government continues to be undeterred from building nuclear weapons. If the international community threatens war then Iran (of either type) has the option to either allow inspectors to confirm its peaceful nuclear ambitions or defiantly pursue nuclear weaponization at the cost of war. Iran (of either type) prefers that the international community do absolutely nothing. Thus Iran's payoffs $V_i \in R^+$ are structured so that $V_3 > V_2 > V_1$. The international community's payoffs are structured to reflect their preference for a non weaponized Iranian state. However the international community prefers to do nothing over actually going to war.⁴ Thus the international community's payoffs $U_j \in R^+$ are structured so that $U_1 > U_3 > U_2$. This game is represented in Figure 1.

Given the structure of the game, we note the following: A hard-line Iran (R_H) will always "Defy" the threat of war while a pliant Iran (R_S) will "Acquiesce". The problem for the international community of course is that they do not know with certainty the type of Iran they are facing. This uncertainty matters of course. War is costly for the international community. They would prefer that Iran acquiesce but there is a p chance that that Iran will defy. The question then becomes – is it possible for the international community to use the threat of war in a way that separates the two types of Iran? In the next section we will explore the conditions under which a probabilistic threat is credible and indeed whether such a threat can actually eliminate the actual realization of war.

3 Equilibria, propositions, and discussion

In this section we suggest that the international community (I) can use a threat of war, $q \in (0, 1]$, to deter the Iranian government from building nuclear weapons. Thus, if the Iranian government is "rational" and therefore likely to back down from a nuclear weapons program when faced with the possibility of

⁴This seems like a plausible assumption given the current state of the world and the fact that Iran has not been invaded – yet!

war, then I may actually avoid war with a calibrated threat. However, if an escalating threat of war does not lead to deterrence then the international community could reasonably conclude that the Iranian government is hard-line and wedded to the idea of a nuclear weapon at all costs. This would be an improvement in the information content of negotiators who wish to keep Iran from going nuclear and would therefore enhance the generation of policy options. Below we look at some of the parameters that determine this calibration.

3.1 The Propositions

Proposition 1 *The threat of war q is effective in deterring R_S only if $q > \frac{V_2 - V_3}{V_1 - V_3}$.*

Proof. We know that a hard-line Iran would always defy the threat of an invasion by the international community. Thus the interesting question is whether a calibrated threat of war would force a more rational "Soft" Iran (R_S) to acquiesce. For this to happen the expected payoff to R_S from defying the threat of war has to be less than the expected payoff from acquiescing. Note that the chance that I carries out the threat of war is only q – in which case the payoff to R_S is V_1 . . Thus there is a $1 - q$ chance that effectively the international community does nothing and the payoff to R_S is V_3 . Therefore, the expected payoff to R_S from defying the threat is $qV_1 + (1 - q)V_3$. On the other hand, R_S could acquiesce and get a payoff of V_2 . Thus, R_S will acquiesce only if q at least satisfies the equation

$$qV_1 + (1 - q)V_3 = V_2,$$

Thus the solution is:
$$\begin{cases} \left\{ \frac{1}{V_1 - V_3} (V_2 - V_3) \right\} & \text{if } V_1 - V_3 \neq 0 \\ \mathbb{C} & \text{if } V_1 - V_3 = 0 \wedge V_2 - V_3 = 0 \\ \emptyset & \text{if } V_2 - V_3 \neq 0 \wedge V_1 - V_3 = 0 \end{cases}$$

Since $V_i \in R^+$ and $V_3 > V_2 > V_1$ proposition 1 is true. ■

Proposition 1 therefore suggests that a minimum threat of war can be calibrated to deter a soft Iranian government from pursuing nuclear ambitions.

Proposition 2 *It is always possible to find a lower limit to a credible threat of war that will deter R_S from building nuclear weapons.*

Proof. Given $V_3 > V_2 > V_1$ it follows that $V_1 - V_3 > V_2 - V_3 > 0$. Thus $0 < q < 1$. ■

Proposition 2 suggests that given certain plausible restrictions on the values of Iranian payoffs it is always possible to calibrate a threat to deter Iran's nuclear ambitions. This is certainly a source of some optimism to organizations like the IAEA that, backed by UN Security council resolutions that threaten war, may wish to deter Iran from pursuing WMD's.

Proposition 3 *It is possible to calibrate q so that R_S is deterred from building nuclear weapons.*

Proof. Say q is calibrated so that proposition 1 holds. However it is clear that if for example $q = 1$ and I ex post turns out to be facing R_H then war is inevitable.⁵ Thus whether there is an upper limit on q that maintains a credible deterrence for R_S while avoiding war with R_H is a relevant question. If the international community wishes to avoid war then it should calibrate q so that its expected payoff from threatening war is greater than doing nothing at all given the a priori probability of R_H i.e. p . The expected payoff to the international community from threatening war is $p(qU_2 + (1-q)U_3) + (1-p)U_1$. The payoff to I from doing nothing is U_3 . Thus the threat of war is credible (given proposition 1 holds) only if q at least satisfies the following equation:

$$p(qU_2 + (1-q)U_3) + (1-p)U_1 = U_3,$$

This solution is:

$$\begin{cases} \left\{ \frac{1}{p(U_2 - U_3)} (U_3 - pU_3 + U_1(p-1)) \right\} & \text{if } pU_2 - pU_3 \neq 0 \\ \mathbb{C} & \text{if } pU_2 - pU_3 = 0 \wedge U_1 - U_3 - pU_1 + pU_3 = 0 \\ \emptyset & \text{if } U_1 - U_3 - pU_1 + pU_3 \neq 0 \wedge pU_2 - pU_3 = 0 \end{cases}$$

Since $U_1 > U_3 > U_2$ and $U_j \in R^+$ proposition 3 is true. ■

This proposition suggests that the threat of war need not follow an inexorable path to war while deterring the Iranian government from building the bomb. However there is most certainly an upper limit on the value of q – beyond which war may be inevitable. However, in this context we also note that this upper limit may well be $q = 1$ since there is no a priori reason to limit $p > 1/2$ and $U_3 < \frac{U_1 - U_2}{2}$.

Proposition 4 *An increase in p reduces the credibility of war threats as an instrument that deters R_S from building nuclear weapons.*⁶

Proof. Proposition 3 suggests that a credible threat of war has an upper limit if war is not to be inevitable, i.e. $q < \frac{(1-p)(U_1 - U_3)}{p(U_3 - U_2)}$. It is trivial then to show that $\frac{(1-p)(U_1 - U_3)}{p(U_3 - U_2)}$ falls as p rises. Thus as p rises the range for which q is credible and avoids war (proposition 1 and 3 both hold) becomes more and more limited. ■

Proposition 5 *An decrease in U_1 or an increase in U_2 given U_3 and p reduces the credibility of war threats as an instrument that deters R_S from building nuclear weapons.*⁷

Proof. Proposition 3 suggests that a credible threat of war has an upper limit if war is not to be inevitable, i.e. $q < \frac{(1-p)(U_1 - U_3)}{p(U_3 - U_2)}$. It is trivial then to show that $\frac{(1-p)(U_1 - U_3)}{p(U_3 - U_2)}$ falls with an decrease in U_1 or an increase in U_2 given U_3 and p . Thus as U_1 rises or U_2 falls (ceteris paribus), the range for which q is credible and avoids war (proposition 1 and 3 both hold) becomes more and more limited. In other words the upper limit on the threat of war depends on how much the international community cares about removing Iran's nuclear claws relative to

⁵Since R_H is always defiant – irrational even.

⁶Proposition 3 must hold for proposition 4 to be true.

⁷Proposition 3 must hold for proposition 5 to be true.

the outcome of an invasion – given that I always has the option to do nothing and simply accept Iran as a member of the nuclear weapons club. ■

3.2 Discussion

Proposition 1 and 3 suggest that the credibility of a threat of war and therefore its usefulness as a deterrent has an upper and lower limit; i.e. the threat of war has a limited effectiveness. Proposition 2 injects a note of optimism insofar as it suggests that it is always possible to find a lower limit on the threat of war to deter R_S even if R_H is undeterrable. In fact proposition 2 further suggests that the international community can commence a trajectory for the threat of war – slowly upping the ante till R_S is deterred. However, proposition 3 suggests that if upping the ante for the threat of war does not work then the international community is very likely facing R_H and therefore needs to consider options that do not include the threat of war; e.g. encouraging internal revolution rather than threatening the invasion of Iran. However, searching for this information may not necessarily avoid war – it is clear that the upper limit on q may well be one if $p \leq 1/2$ and $U_3 \geq \frac{U_1 - U_2}{2}$. In other words, given the a priori estimate of a hardline Iranian government and the importance the international community gives to a nuclear Iran relative to the outcome of an invasion, war may well be inevitable if the threat of war is used to search for information on whether the government of Iran is hardline or not. At any rate such an outcome depends on the international communities own payoffs – known to them – and the known probability of a hardline Iran. This knowledge can guide whether the threat of war should be part of the policy options needed to deter Iran from obtaining WMD's. We believe therefore that our approach clearly delineates the mix of policy decisions that are necessary to deter Iran.

4 Conclusion

We do not claim any theoretical advance in our understanding of game theory as it applies to brinkmanship in this paper. We do, however, apply existing knowledge in this area to analyze the extent to which the threat of war could be used to deter Iran from its ambition of being a nuclear power. We find, perhaps unsurprisingly but very clearly, that this extent critically depends on how much the international community cares about not having a nuclear Iran and their perception about the outcome of war with Iran. We find that a minimum threat of war can be a credible deterrent to Iran's nuclear ambition as long as Iran is not irrationally wedded to its nuclear ambition. Moreover, upping the ante on the threat of war can potentially elicit information on whether Iran's government is truly irrational or not. But this approach could inevitably devolve into an actual invasion – though whether it does or not really depends on the international communities perception of its own relative payoffs from war, apathy, and a non-nuclear Iran. Thus brinkmanship would lead to war with Iran only in the unlikely event that the international community dramatically

misperceived its own incentives. This paper therefore clarifies the muddy waters of real life decision making by providing a set of decision making criteria.

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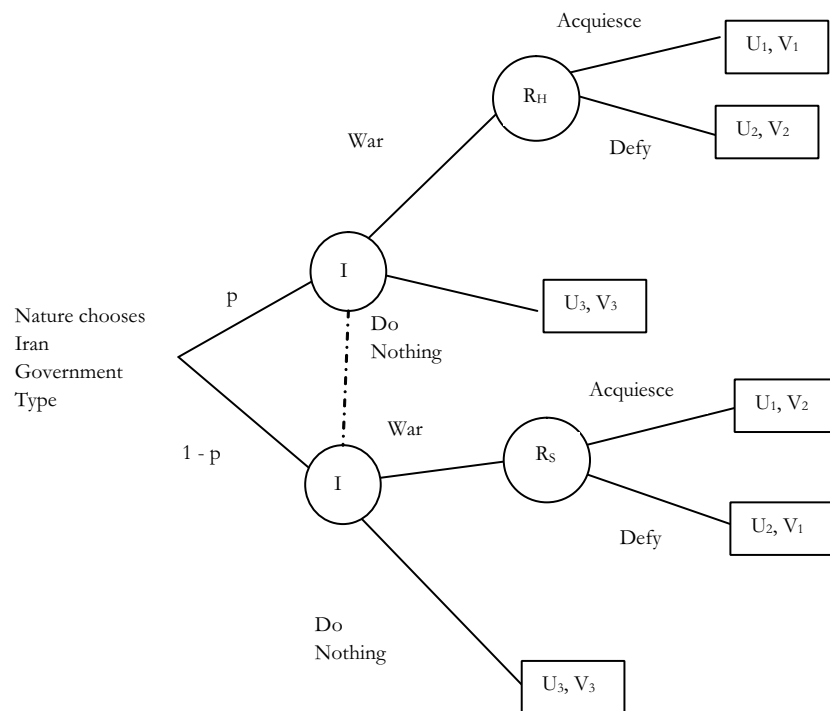


Figure 1: Iran and the International Community: An asymmetric information sequential game